REMARKS

In the latest Office Action, the Examiner rejected Claims 2, 4-12, and 14-17 under 35 U.S.C. §112, paragraph 2, as being indefinite. The Examiner rejected Claims 14, 16, and 17 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,721,413 to Moe (Moe '413).
The Examiner rejected Claims 15, 2, 4, and 6 under 35 U.S.C. 103(a) as being unpatentable over of Moe '413 in view of U.S. Patent No. 4,669,650 (Moe '650) and rejected Claim 5 as being obvious over Moe '413 in view of Japanese Patent No. 03-243286 to Masakatsu et al. (Masakatsu). The Examiner rejected Claims 7, 8, and 9 as being obvious over Moe '413 in view of Masakatsu and Moe '650 and rejected Claims 10-12 as being obvious over Moe '413 in view of Masakatsu, Moe '650, and U.S. Patent No. 3,941,299 to Godfrey (Godfrey). Finally, the Examiner rejected Claims 14-17, 2, 4, and 6 as being obvious over Moe '650 in view of Moe '413, rejected Claims 5 and 7-9 as being obvious over Moe '650 in view of Moe '413 and Masakatsu, and rejected Claims 10-12 as being obvious over Moe '650 in view of Moe '413, Masakatsu, and Godfrey.

With regard to Claims 2, 4-12, and 14-17, the Examiner asserts that the claims are indefinite because the method does not explicitly recite a forge welding step. In response, Applicants have canceled Claims 14, 16, and 17 and added new independent Claim 18, which recites that the method is for forge welding. Further, Claim 18 actively recites the component steps of forge welding, i.e., heating the ends and pressing the ends together. Support for new Claim 18 can be found in Figures 1 and 2 of the drawings, showing the ends being proximate to and in axial alignment with one another (Figure 2), page 2a, lines 1-2 of the specification, Figure 1, showing the first and second

ends pressed together, and Table 1, showing the inward angles. No new matter has been added.

The Examiner rejected Claims 14, 16, and 17 as being anticipated by Moe '413. Applicants have canceled Claims 14, 16, and 17. Applicants had previously argued that Moe '413 teaches only deformation by pressing the ends together, not deformation by thermal expansion. The Examiner responded by noting that thermal expansion necessarily occurs during the heating process and deforms the tubes (April 12, 2010 Office Action, page 12, paragraph 13). Applicants grant the Examiner's assertion that heated ends of tubulars do expand when heated, but Applicants maintain their assertion that Moe '413 does not teach deformation due to thermal expansion in the manner claimed by the Applicants.

Nonetheless, Applicants believe that new Claim 18 effectively addresses the Examiner's concerns and yet preserves the available claim scope. First, Claim 18 explicitly requires that the step of angularly displacing the outer wall into a substantially longitudinally oriented cylindrical surface be done by *thermal expansion*. Applicants have taken advantage of the thermal expansion of the tubular ends by utilizing the predetermined inward angle aspect to create a stronger weld. In addition to the normal weld strength associated with pressing the heated tubular ends together, the first and second ends form an interference fit that keeps the ends of the joined tubulars from separating.

Second, Claim 18 requires that the inward angle be predetermined. Unlike the cited prior art, the claimed inward angle is calculated *beforehand*, either through an iterative process or through experimentation. See specification page 4, lines 3-8. Any thermal expansion occurring in Moe '650 and Moe '413 is not being used in a calculated manner along with the outer wall or the shape of the ends to effect a strong weld.

Third, Claim 18 requires that the predetermined inward angle be from approximately one degree to approximately five degrees, i.e., it is macroscopic. This distinguishes over the Examiner's argument that any heated tubular end expands, even if microscopically, when heated. Further, the claimed thermal expansion is not only macroscopic, but it achieves a *defined* result: displacing the outer wall into a substantially longitudinally oriented cylindrical surface. By specifying a range for the inward angle, Applicants are distinguishing the claimed thermal deformation from both the prior art and the thermal deformation that occurs naturally when an object is heated.

Fourth, Claim 18 also requires that the step of pressing the second end into the first end be done while the first and second ends are in the heated condition. This ensures that the first and second ends have reached the predetermined heated condition (and, therefore, the angular displacement has already taken place) *prior to and independent of* any subsequent mechanical deformation that is related to the step of pressing. Thus, mechanical deformation is not completely excluded from the forge welding process, only mechanical deformation associated with the angular displacement of the outer wall during the heating step. Since neither Moe '413 nor any other cited reference teaches or makes obvious the thermal expansion of the tubular end from a predetermined inward angle to a substantially longitudinally oriented cylindrical surface, where the inward angle is from approximately 1-5 degrees, new independent Claim 18 defines over the prior art.

The Examiner rejected Claims 15, 2, 4, and 6 as being obvious over Moe '413 in view of Moe '650. Claims 15, 2, 4 and 6 are patentable at least for their dependency on Claim 18. With regard to Claim 15, Applicants have amended the claim to include the predetermined inward angle of the outer wall, rather than the sloping configuration. The Examiner cites column 3, lines 11-15 and 24-36 for the proposal that Moe '650 teaches selecting the sloping configuration and,

presumably, the inward angle, such that the ratio between the diameter at the tip and the diameter at the base is related to an estimated temperature difference and a thermal coefficient of expansion. It does not. The cited paragraphs relate only to the force and material properties required for *mechanical* deformation. The cited text makes no reference to a temperature difference or a thermal expansion coefficient. As a result, Claim 15 defines over the prior art.

The Examiner rejected Claim 5 as being obvious over Moe '413 in view of Masakatsu and rejected Claims 7-9 as being obvious over Moe '413 in view of Masakatsu and Moe '650. Claims 5 and 7-9 are patentable at least for their dependency on Claim 18.

The Examiner rejected Claims 10-12 as being obvious over Moe '413 in view of Masakatsu, Moe '650, and Godfrey and rejected Claims 14-17, 2, 4, and 6 as being obvious over Moe '650 in view of Moe '413. Applicants have canceled Claims 14, 16, and 17. Claims 10-12, 15, 2, 4, and 6 are patentable at least for their dependency on Claim 18. Further with regard to Claim 15, Applicants reiterate their argument above that Moe '650 does not teach selecting an inward angle based on a temperature difference or a thermal expansion coefficient.

The Examiner rejected Claims 5 and 7-9 as being obvious over Moe '650 in view of Moe '413 and Masakatsu and rejected Claims 10-12 as being obvious over Moe '650 in view of Moe '413, Masakatsu, and Godfrey. Claims 5 and 7-12 are patentable at least for their dependency on Claim 18.

Applicants have added new Claim 19, directed to the step of forming a first end such that, in the unheated condition, an inner wall of the first end is disposed at the predetermined angle and angularly displacing the inner wall of the first end by thermal expansion into a substantially longitudinally oriented cylindrical surface. Support for new Claim 19 can be found in Figure 2 and

on page 5, lines 10-19, page 6, lines 1-6. No new matter has been added.

Applicants have added new Claims 20-24. Support can be found in Figures 1, 2, and 4 and in the specification on page 2a, lines 1-12, page 3, lines 9-24, page 4, lines 3-8, page 5, lines 10-19, and page 6, lines 1-6. No new matter has been added and Claims 20 - 24 are patentable at least for their dependency on Claim 18.

With regard to Claim 20, Applicants use an annular channel having a radially outward wall that is disposed at the predetermined inward angle to form the interference fit discussed above. This method provides additional strength because, upon cooling, the thermally expanded outer wall attempts to return to the initial inward angle but is prevented from fully doing so by the end of the other tubular to which it is now joined. This provides circumferential compression of one end around at least part of the other and results in a stronger weld.

In summary, the Applicants have revised the claims to more particularly define the claimed invention and more explicitly recite the steps of interconnecting the tubular members. The Applicants believe that the application is now in condition for allowance. The requisite fee for a two month extension of time is being filed with this Reply and Request for Continued Examination. The Commissioner is hereby authorized to charge any deficiency to Deposit Account No. 503982 of Momkus McCluskey, LLC.

Respectfully submitted,

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